REMARKS

Reconsideration of the above-identified patent application in view of the amendments above and the remarks following is respectfully requested.

Claims 1–38 are in this case. Claims 1–4, 7–8, 12, 15–19, 22, 24–25, have been rejected under 35 U.S.C. 102(e). Claims 5 and 29–36 have been rejected under 35 U.S.C. 103(a). Claims 6, 9–11, 13, 14, 20, 21, 23, 37, and 38 have been objected to. Claims 26-28 have been allowed. Claims 6, 9-11, 13, 14, 20, 21, 23, 30, 37 and 38 have been canceled. Independent claim 29 and dependent claims 12 and 22 have been amended. New claims 39-49 have been added.

The claims before the Examiner are directed toward a method and system for finding the position of a mobile unit with respect to beacons such as the satellites of a satellite network such as the Global Positioning System. Each beacon transmits a signal that consists of a series of frames of a pseudo-noise sequence. The frames of a received signal are arranged as columns of a matrix and are processed coherently to provide estimated pseudo-ranges and estimated rates of change of pseudo-ranges for beacons in view. The coherent processing includes performing an orthogonal transform on the rows of the matrix, multiplying the elements of the matrix by Doppler compensation factors, and then, for each beacon in view, convolving the columns of the matrix with the pseudo-noise sequence of that beacon.

35 U.S.C. §102(e) Rejections — Casabona *et al*, US Patent 5,872,540

The Examiner has rejected claims 1–4, 7–8, 12, 15–19, 22, 24–25, under § 102(e), as being anticipated by Casabona *et al*, US Patent No. 5872540 (henceforth "Casabona").

The Examiner alleges that Casabona has disclosed the methods of claims 1 and 16 and the receiver of claim 25.

The current invention is of a method to determine a pseudo-range and a rate of change thereof to a beacon; Casabona discloses a system for suppressing interference and jamming in spread-spectrum signals, which could include the beacon signals of the present invention.

The present invention receives a beacon signal; digitizes the signal; arranges consecutive bits of the digitized signals as consecutive columns of an input matrix such that each column corresponds to an integral number of frames of a characteristic pseudo-noise sequence underlying the signal; and produces a transformed matrix by performing a discrete orthogonal transform on each row of the input matrix. Each element of the transformed matrix is subsequently multiplied by a respective Doppler compensation factor, which may be based on an estimate of a frequency shift. Each column of the Doppler compensated matrix is next convolved with the pseudo-noise sequence. Subsequently, a peak value or values of elements in the convolved matrix are identified and, from the row and column coordinates of thereof, are determined most likely pseudo-range and rate of change thereof respectively.

The invention of Casabona receives a spread-spectrum signal; divides the signal into two orthogonally polarized analogue components; digitizes both components separately; provides these digital input signals to a digital polarimeter using a set of phase modulation coefficients for numerically generating digital output signals with suppressed interference levels; provides the output to a spread spectrum receiver in digital format, or reconverted to analogue format as required, for

navigation processing. The invention includes providing the original digital input signals to a detection nulling receiver and phase modulation coefficient generator responding to the digital inputs and to digital polarimeter output signals for programming and updating polarimeter phase-modulation.

It is important to note that nowhere does Casabona teach arranging consecutive bits of digitized signals as consecutive columns of an input matrix such that each column corresponds to an integral number of frames of a characteristic pseudo-noise sequence; performing a discrete orthogonal transform on each row of the input matrix; or multiplying each matrix elements by a respective Doppler compensation factor. All of these are integral elements of the present invention.

In Casabona, matrix representation and orthogonal transforms are all to do with noise suppression and do not relate to decoding pseudo-random encoded beacon signals. The similarities arise from the use of standard signal-processing techniques, but the total package is quite unrelated to the present invention.

In particular, Casabona's use of an orthogonal transform (col.10, lines 5–25) is quite different from that of the present invention. Orthogonal transforms include a very broad range of transforms characterized by the property that, for the transform matrix, the product of the matrix with its transpose is the unit matrix. They are used in many different circumstances. Casabona uses it to effect rotation for phase-shifting of the two in-quadrature signal components. By contrast, in the present invention, the transform is applied to each of the 4092 rows of the signal matrix in order to transform the rows of the matrix from the time domain to the frequency domain. Applicant submits that it is not tenable that Casabona has anticipated this.

Moreover, Casabona does not relate at all to determining pseudo-range and a rate of change thereof.

It being the case that Casabona's goal is completely different and the methods only superficially similar, it is submitted that not only does Casabona not anticipate the present invention as recited in independent claims 1, 16 and 25, but the present invention, as recited in independent claims 1, 16 and 25, is not even obvious from Casabona.

Applicant therefore submits that independent claims 1, 16, and 25 are in condition for allowance in their present form.

With independent claims 1, 16 and 25 in condition for allowance in their present form, it follows that dependent claims 2–3, 15, 17–21, and 24 that depend therefrom are also in condition for allowance in their present form.

35 U.S.C. §103(a) Rejections — Casabona *et al* in view of Krasner

The Examiner has rejected claim 5 under §103(a) as being unpatentable over Casabona in view of Krasner, US Patent No 6,289,041 B1 (henceforth "Krasner"). The Examiner's rejection is respectfully traversed.

It is demonstrated above that independent claim 1 is in condition for allowance in its present form. It follows that claim 5 that depends therefrom also is in condition for allowance.

35 U.S.C. §103(a) Rejections — Thomson *et al* in view of Hoshino *et al*

The Examiner has rejected claim 29 under §103(a) as being unpatentable over Thomson *et al*, US Patent No 6,304,760 B1 (henceforth "Thomson"), in view of Hoshino *et al*, US Patent No 6,081,230 (henceforth "Hoshino"). The Examiner's rejection is respectfully traversed.

As noted below, claim 29 has been amended to include the limitations of claim 30. This amendment renders moot the Examiner's rejection of claim 29.

35 U.S.C. §103(a) Rejections — Thomson *et al* in view of Hoshino *et al* and further in view of Casabona *et al*

The Examiner has rejected claim 30 under §103(a) as being unpatentable over Thomson, in view of Hoshino, and further in view of Casabona. The Examiner's rejection is respectfully traversed.

Thomson teaches a method and system for reducing the effects of atmospheric ducting on wireless transmissions in a wireless communication system comprised of a plurality of base stations, each base station having antennas, a beacon signal transmitter, and a beacon signal receiver, by transmitting a wireless beacon signal from each base station to each other base station in the system; measuring a time delay and a propagation loss of each wireless beacon signal; comparing the time delay and propagation loss to an expected time delay and propagation loss corresponding to that wireless beacon signal; processing the results of the comparison step so as to determine a location of an atmospheric duct; and arranging an antenna at each said base station to minimize duct effects.

In one embodiment of Thomson, the beacon signals are advantageously orthogonal codes, or pseudo-random signals, to be received by a beacon signal receiver employing a correlation receiver. This permits, by standard GPS techniques, the measurement of time delay. Thomson does not, however, as the Examiner states, infer, for each beacon a pseudo-range and rate of change thereof.

Hoshima teaches a variety of hybrid navigational systems, including GPS, wherein complementarity between system components is used to improve accuracy. The common link with Thomson is use of GPS, again employing standard GPS techniques to measure a pseudo-range and rate of change thereof.

As already stated above, Casabona discloses a system for suppressing interference and jamming in spread-spectrum signals and does not calculate pseudo-range and rate of change thereof.

For the reasons already stated in relation to claim 1, it is contended that it is not obvious to one of ordinary skill in the art to implement the teaching of Casabona into Thomson and Hoshino so as to achieve the aims of the present invention, although that may be so to achieve the suppression of interference and jamming, which not an aim of the present invention. Therefore, claim 30 is allowable over the prior art cited by the Examiner. Consequently, while continuing to traverse the Examiner's rejections, Applicant has, in order to expedite the prosecution, chosen to amend independent claim 29 to include the limitations of claim 30. Correspondingly, claim 30 has been cancelled

Amended independent claim 29 now features language that makes it absolutely clear that the method of the present invention includes inferring pseudo-ranges and pseudo-range rates by digitizing the signals received collectively from the

beacons, arranging the digitized signal as columns of a matrix such that each column corresponds to one or more pseudo-noise sequence frames, and performing a discrete orthogonal transform on each row of the matrix. Applicant believes that the amendment of the claims completely overcomes the Examiner's rejections on §103(a) grounds and that amended claim 29 is now in condition for allowance.

35 U.S.C. §103(a) Rejections — Nakamura in view of Abbot

The Examiner has rejected claims 31–33 under §103(a) as being unpatentable over Nakamura, US Patent No 6,041,074 (henceforth "Nakamura"), in view of Abbot *et al*, US Patent No 6,516,021 B1 (henceforth "Abbot"). The Examiner's rejection is respectfully traversed.

It is difficult to determine the Examiner's reason for rejection. At the outset, the Examiner states that:

> "... Nakamura discloses a method for determining a pseudo ranges and a rate of change thereof ... "

but later says that:

> "However, Nakamura matched filter does not extract the pseudo range and the rate of change of the pseudo range."

The Examiner than notes that Abbott teaches a Kalman filter, which, the Examiner asserts, is equivalent to the claimed (matched filter) to extract the pseudo-range and the rate of change of the pseudo-range and that it would have been obvious to implement the teaching of Abbott into Nakamura as to determine the first and second derivatives time rate of the pseudo-range as taught by Abbott.

A Kalman filter is, however, completely different from a matched filter. Kalman filtering is a statistical technique that combines a knowledge of the statistical

nature of system errors with a knowledge of system dynamics, as represented as a state space model, to arrive at an estimate of the state of the system. The state estimate utilizes a weighing function, called the Kalman gain, which is optimized to produce a minimum error variance. (See: Kaplan E.D. Editor, *Understanding GPS, Principles and Applications*, Artech House, 1996, pp 391–395, a copy of which is attached.) Abbott incorporates inertial measurements to assist in improving precision.

A matched filter to the signal $s(t)$ is a filter whose impulse response $h(t)=s(T-t)$, where $s(t)$ is assumed to be confined to the time interval $0 \leq t \leq T$. The response of $h(t)=s(T-t)$ to the signal $s(t)$ is basically the time-autocorrelation function $s(t)$. (See: John G. Proakis, *Digital Communications*, 3rd ed., McGraw-Hill, 1995, pp 238-244, a copy of which is attached.) A matched filter thus passes all the signal frequency components while suppressing non-signal frequency components and, in order to get the maximum signal-to-noise ratio, and also weights the filtering towards signal frequency components that are larger by using correlation to detect a known waveform.

Applicant submits that there is no obvious way to combine Abbott and Nakamura to obtain the present invention as recited in claim 31.

With independent claim 31 allowable in its present form, it follows that claims 32 and 33, that depend therefrom, also are allowable.

35 U.S.C. §103(a) Rejections — Nakamura in view of Abbot and of Casabona

The Examiner has rejected claims 34–36 under §103(a) as being unpatentable over Nakamura, in view of Abbot, and further in view of Casabona. The Examiner's rejection is respectfully traversed.

It is demonstrated above that independent claim 31 is allowable in its present form. It follows that claims 34–36, that depend therefrom, also are allowable.

Objections

The Examiner has objected to claims 6, 9–11, 13, 14, 20, 21, 23, 37, and 38 as being based on rejected base claims. The Examiner has noted that claims 6, 9–11, 13, 14, 20, 21, 23, 37, and 38 would be allowable if rewritten in independent form including all the limitations of the base claim and any intervening claim.

In view of the discussion above in the context of the § 102(e) and § 103(a) rejections, Applicant submits that the base claims from which claims 6, 9–11, 13, 14, 20, 21, 23, 37, and 38 depend are allowable, making claims 6, 9–11, 13, 14, 20, 21, 23, 37, and 38 allowable in their present form.

Nevertheless, Applicant has rewritten claims 6, 9, 10, 13, 14, 20, 23, 37 and 38 in independent form, as new claims 39-41, 43-45, 47 and 48, respectively. New claim 42 is claim 11 rewritten to depend from new claim 41. New claim 46 is claim 21 rewritten to depend from claim 45. New claim 49 is claim 38 rewritten to depend from claim 48. Correspondingly, claims 6, 9-11, 13, 14, 20, 21, 23, 37 and 38 have been canceled.

Other Amendments to the Claims

An inadvertent misnumbering of the steps of claim 12 has been corrected.

The preamble of Claim 22 has been amended to delete the word "said", an inadvertent typographical error.

Amendments to the Specification

Some of the variables in the equations on page 30, lines 1 and 16, have been changed to bold italic font, for stylistic consistency with the rest of the specification.

No new matter has been added.

In view of the above amendments and remarks it is respectfully submitted that independent claims 1, 16, 25, 26, 29, 31, 39–41, 43–45, and 47–48 and hence dependent claims 2-5, 7, 8, 12, 15, 17–19, 22, 24, 27–28, 32–36, 42, 46, and 49 are in condition for allowance. Prompt notice of allowance is respectfully and earnestly solicited.

Respectfully submitted,

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Date: December 10, 2003